

(Twice Amended) 1. A method for performing an ion implantation comprising:

providing a target chamber for containing a target for implantation and an ion source chamber including an ion source for generating an ion beam;

disposing right in front of said target a beam deceleration optics that includes means for generating an off-axis electric field for decelerating and deflecting charged particles in a vertically spread beam of said ion beam to project toward said target along a deflected angle away from neutralized particles in said ion beam.

(Twice Amended) 2. The method of performing an ion implantation of claim 1 wherein:

disposing an analyzer magnet right at an exit of said ion source chamber for mass filtering said ion beam.

(Twice Amended) 3. The method of performing an ion implantation of claim 1 wherein:

said step of disposing said deceleration optics further comprising a step of disposing electrodes right in front of said target chamber for generating said off-axis electrical field for decelerating and deflecting said charged particles in said vertically spread beam of said ion beam.

(Same-Amended) 4. The method of performing an ion implantation of claim 1 further comprising:

disposing said target on a target support and disposing said target support at an inclined angle whereby said target is substantially perpendicular to a projection direction of said charged particles projected along said deflected angle.

(Twice Amended) 5. The method of performing an ion implantation of claim 1 further comprising:

disposing a neutralized beam blocking means between said deceleration optics and said target for blocking said neutralized particle from reaching said target.

(Twice Amended) 6. The method of performing an ion implantation of claim 1 wherein:

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said step of providing an ion source in an ion source chamber is a step of providing an ion source for generating a positive charged ion beam; and

said step of disposing said beam deceleration optics includes a step of disposing a means for generating a negative off-axis electric-field for decelerating and deflecting said charged particles in said ion beam as said vertically spread beam.

(Twice Amended) 7. The method of performing an ion implantation of claim 1 wherein:

said step of generating said off-axis electrical field for decelerating and deflecting said charged particles in said ion beam as said vertically spread beam is a step of deflecting said charged particles at a small deflected angle relative to a projected direction of neutralized particles.

(Twice Amended) 8. The method of performing an ion implantation of claim 7 wherein:

said step of decelerating and deflection said charged particles in said ion beam as said vertically spread beam comprising a step of deflecting said charged particles at a small deflected angle in a range of three to fifteen degrees relative to a projection direction of said neutralized particles.

(Twice Amended) 9. The method of performing an ion implantation of claim 1 wherein:

said step of providing said ion source in said ion source chamber comprising a step of providing said ion source chamber and said target chamber with a vacuum of approximately 10^{-5} Torr; and

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said step of decelerating and deflecting said charged particles is a step of decelerating said charged particles in said ion beam to an energy level as low as about 200 eV with an energy contamination of less than about 0.1%.

(Twice Amended) 10. A method for generating an implantation ion beam from an ion source projecting a plurality of ions comprising:

disposing a beam deceleration means right in front of a target wafer of implantation for decelerating and deflecting charged particles in said ion beam as a vertically spread beam away from neutralized particles in said ion beam to project decelerated and deflected charged particles to said target wafer of implantation.

(Twice Amended) 11. The method of claim 10 further comprising:

arranging a wafer implant position with a small inclined angle relative to a projection direction of said neutralized particles corresponding to and substantially perpendicular to a projection direction of said charged particles for accepting said charged particles projected thereto.

(Twice Amended) 12. The method of claim 10 further comprising:

disposing a blocking means between said decelerating means and said target wafer for blocking said neutralized particles from reaching said target wafer of implantation.

(Twice Amended) 13. The method of claim 10 wherein:

said step of disposing said decelerating means further comprising a step of disposing electrodes right in front of said target for generating an off-axis electric field for decelerating and deflecting said charged particles away from neutralized particles in said ion beam.

(Twice Amended) 14. The method of claim 10 wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam having a beam-height to beam-width ratio ranging substantially between 4 and 20.

(Twice Amended) 15. The method of claim 10 further comprising:

disposing a beam block between said deceleration means and said target wafer for blocking said neutralized particles.

(Twice Amended) 16. The method of claim 10 wherein:

said step of decelerating and deflecting said charged particles away from neutralized particles in said ion beam further comprising a step of decelerating and deflecting said charged particles into a high-aspect ratio beam having a ratio of a beam height to a beam width ranging substantially between 4 and 20.

(Twice Amended) 17. The method of claim 16 wherein:

said step of deflecting said charged particles into a high aspect-ratio beam comprising a step of providing an extraction aperture for said ion source with an aspect ratio ranging substantially between 4 and 20.

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(Twice Amended) 18. The method of claim 16 wherein:

said step of deflecting said charged particles into a high aspect ratio beam comprising a step of deflecting said charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4.

(Twice Amended) 19. The method of claim 18 wherein:

said step of deflecting said charged particles into an ion beam having a beam-height to beam-width ratio equal or greater than 4 comprising a step of providing an aperture to said beam deceleration means wherein said aperture having a beam-height to beam-width ratio equal or greater than 4.

(Twice Amended) 20. The method of claim 13 wherein:

said step of deflecting said charged particles away from neutralized particles comprising a step of deflecting said charged particles to project at an angle in a range of three to fifteen degrees relative to a projection direction of said neutralized particles.
